IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	:	
Yukio Yamaji et al.	:	Confirmation No.: 6232
Application No. 10/528,228	:	TC/Art Unit: 1733
Filed : March 18, 2005	:	Examiner :Steven Maki
For : APPARATUS AND METHOD FOR FRACTIONATING GYPSUM SLURRY AND METHOD OF PRODUCING GYPSUM BOARD	:	Atty Docket :P70312US0

DECLARATION UNDER 37 C.F.R. 1.132

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

Sir:

I, Katsumi Niimi, declare as follows:

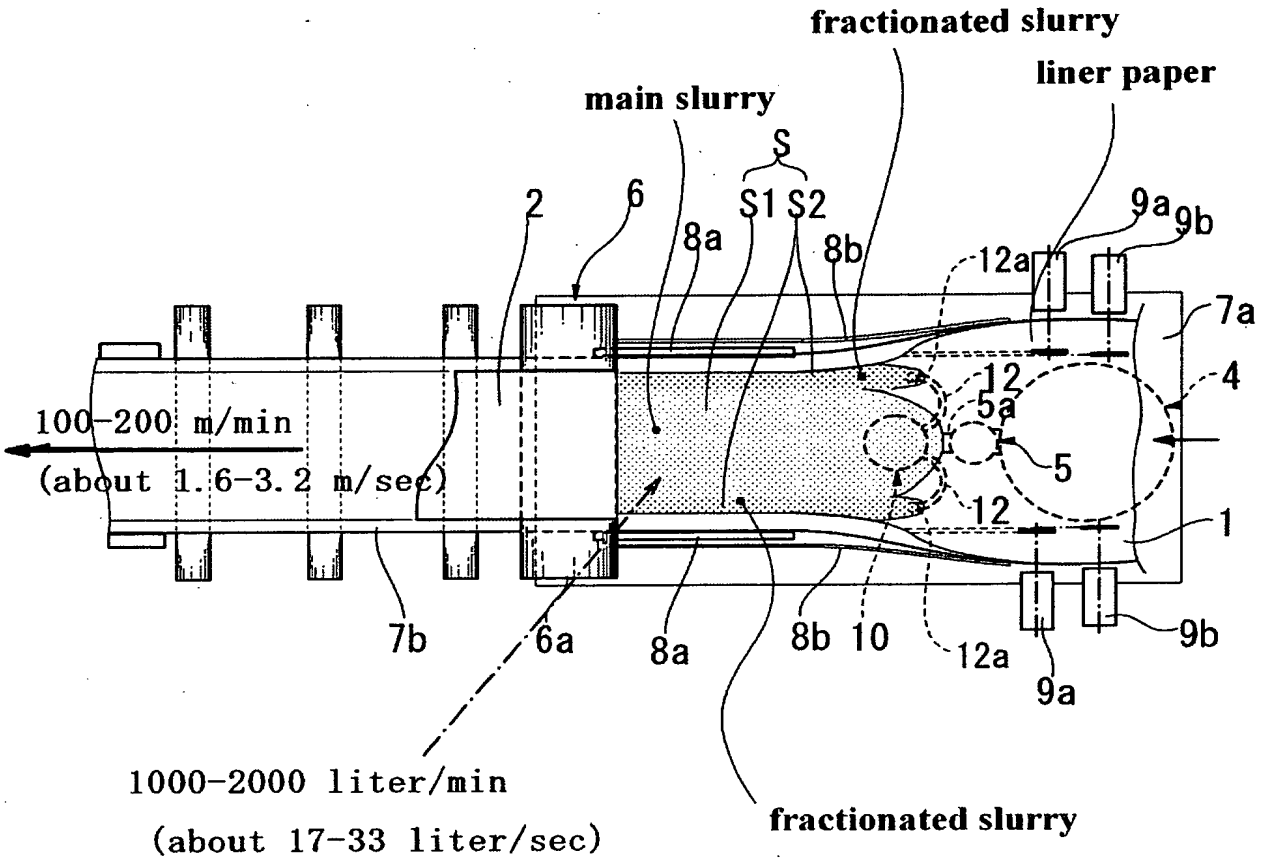
1. I am a mechanical engineer in a technical field of production of gypsum boards and other gypsum or plaster products, and I have a long-term experience of development, planning, design, assembly, construction and operation maintenance of gypsum board production machines.

2. I received a bachelor of engineering degree from Chiba Institute of Technology in March 1981 and have been employed at YOSHINO GYPSUM Co., Ltd., since 1981, as a mechanical engineer. I am a department manager of the Engineering Department of YOSHINO GYPSUM Co., Ltd., at present.

3. I am aware that the claims of the above-captioned U.S. Patent Application No. 10/528,228 (the present application) have been rejected as being unpatentable over United States Patent No. 5,714,032 (Ainsley et al), Japanese Patent Laid-open Publication No. 08-112808 (Yamaji et al), United States Patent No. 6,878,321 (Hauber et al), United States Patent No. 6,193,408(Miura et al), PCT International Publication No. WO 93/03899 (Bold), United States Patent No. 5,683,635 (Sucech et al), and United States Patent No. 6,190,476 (Seecharan et al).

4. As is well-know in the art, a gypsum board widely used as a building material is known as a board having a gypsum core covered with sheets of paper for gypsum board liner. In production of gypsum boards in recent years, the gypsum slurry tends to be prepared by a single mixer, in which calcined gypsum and water are mixed for preparation of the gypsum slurry, as disclosed in JP 08-112808 (Yamaji et al), US 5,683,635 (Sucech et al) and US 6,878,321 (Hauber et al). Usually, a pump is unusable for fractionating (partially extracting) the slurry from the mixer as disclosed in these publications.

As shown in the following figure, the speed (velocity) of the liner paper in gypsum board production machines in recent years is, in general, set to be in range from 100-200 m/min (about 1.6-3.2 m/sec). In a case where the width and thickness of the board is set to be 1 m and 1 cm, the total flow rate of the slurry fed to the liner paper is in a range of 1000-2000 liter/min (about 17-33 liter/sec).



For such a high speed feeding of the slurry onto the liner paper, a mixer having a high internal pressure and a high discharge rate is used in the gypsum board production machine in recent years. It is difficult to use a booster pump, a volumetric dosage pump or an additional or secondary mixer for fractionation. Therefore, the fractionation is conducted by the internal pressure of a single mixer with a high internal pressure and a high discharge rate.

The reason for disuse of such a pump or a secondary mixer for fractionation is considered to be mainly as follows:

(i) Difficulty of control in mixing condition of the materials (calcined gypsum, water, foaming agent and so forth);

(ii) Difficulty of control in fluidity of the slurry, owing to short setting or

curing time of the slurry after mixing;

(iii) Difficulty of control in the foam content in the slurry (i.e., Difficulty of control of the density or specific gravity of the slurry) ; and

(iv) Difficulty of control in the flow rate of the slurry discharged from each of slurry discharge ports.

The problem resulting from early setting or curing of slurry is also described as "plugging problem" in columns 1 and 6 of US 6,190,476 (Seecharan et al).

Therefore, as shown in the table on page 9, the mixers as disclosed in JP 08-112808 (Yamaji et al), US 5,683,635 (Sucech et al) and US 6,878,321 (Hauber et al) have the arrangement in that the slurry is fractionated directly from the internal area of the single mixer, on the assumption that the pressure in the mixer is high, uniform and stable.

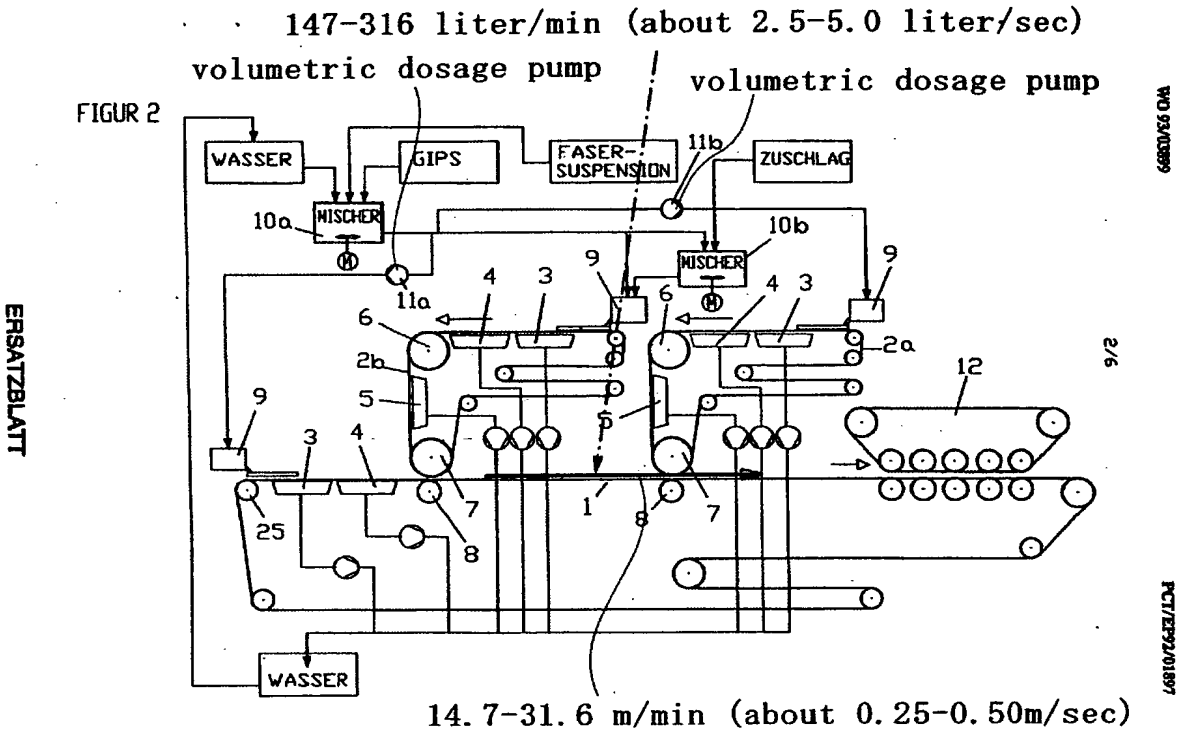
On the other hand, in an apparatus as disclosed in US 5,714,032 (Ainsley et al), two kinds of slurry are prepared by two-stage mixing steps with use of two different mixers (12, 14), as shown in the table on page 9. Further, pumps (26, 26') are used for extracting a part of the slurry from the first-stage mixer (12). Even if a part of the slurry from one of the mixers is fractionated therefrom, the main slurry is not fed to the liner paper (32) on the production line, but it is fed to the second-stage mixer (14) as the material to be mixed with foam (22), for preparation of another slurry. Since a plurality of mixers is used for preparations of slurry in different conditions, fractionation of the same slurry from the same mixer cannot be carried out, and therefore, such an apparatus would encounter the difficulties (i),(ii),(iii) and (iv) as set forth above.

An apparatus as disclosed in WO 93/03899 (Bold) have a pump or

pumps for extracting and delivering the slurry to a water-permeable transport belt (not a sheet of liner paper). In this technical field, it is well-known that a gypsum board widely used as a building material has a gypsum core covered with sheets of paper for gypsum board liner. Adhesion of the liner paper and the gypsum core is an important performance of the gypsum board, as is understandable from FIG. 11 of US patent application No. 10/528,228 (the present invention). This is also described as "adhesion problem" in column 1 of US 6,190,476 (Seecharan et al).

The gypsum-fiber plate produced by the apparatus of WO 93/03899 (Bold) is a building material without the liner paper, which differs from the gypsum board with the liner paper, and which does not relate to the matter of adhesion between the liner paper and the gypsum core.

Further, as shown in the figure on the next page, the speed of the water permeable belt (1) is in range from 14.7-31.6 m/min (about 0.25-0.50m/sec) as shown in Table 1 on page 13 of WO 93/03899, since the suction zones (3, 4) act on the underside of the belt (1) for dewatering. In a case where the width and thickness of the board is set to be 1 m and 1 cm, the flow rate of slurry fed to the belt is 147-316 liter/min (about 2.5-5.0 liter/sec).



Hence, the apparatus of WO 93/03899 (Bold) has a plurality of mixers for mixing gypsum slurry and a volumetric dosage pump or pumps for delivering the gypsum slurry to the water-permeable transport belt (1) (not a sheet of liner paper), as shown in the above figure. However, if the arrangements of the plural mixers or the pump or pumps as disclosed in WO 93/03899 (Bold) are applied to production of gypsum boards, such an apparatus would encounter the difficulties (i),(ii),(iii) and (iv) as set forth above.

The apparatus as disclosed in US 6,190,476 (Seecharan et al) has a 1st mixer (the mixer 44) and 2nd mixers (the densification mixers 54,55), as shown in the table on page 9. In order to overcome "plugging problems", additional water is added to the 2nd mixer (54, 55) for controlling the fluidity or viscosity of the high density gypsum, as described on column 6, lines 23-31 of US 6,190,476 (Seecharan et al), and therefore, the mixing condition of

slurry is changed by addition of water in this case.

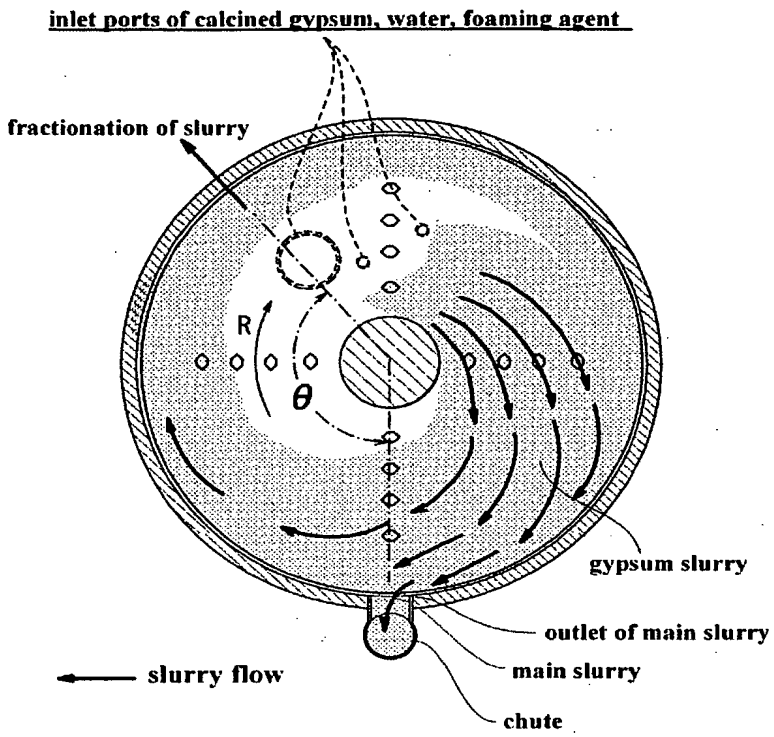
Also in this case, the apparatus provided with the 1st and 2nd mixers would encounter the difficulties (i),(ii),(iii) and (iv) as set forth above.

In the mixer disclosed in each of JP 08-112808 (Yamaji et al), US 5,683,635 (Sucech et al) and US 6,878,321 (Hauber et al), the slurry is fractionated directly from the internal area of the single mixer, as shown in the figure on the next page.

However, in these mixers, the main slurry and the fractionated slurry have to leave the mixing area at different circumferential positions or points spaced at an angle θ from each other, as shown in the figures on the next page. Therefore, even in the mixers disclosed in JP 08-112808 (Yamaji et al), US 5,683,635 (Sucech et al) and US 6,878,321 (Hauber et al), the main slurry and the fractionated slurry have different mixed conditions. This is because the materials (slurry) moving toward the fractionation port are further mixed in the mixer while moving over the range of angle θ .

Thus, the mixing condition of the slurry fractionated or separated from the main slurry differs from that of the main slurry, in all of the cited references, as shown in the table on page 10.

Image of Gypsum Slurry Flow in Mixer



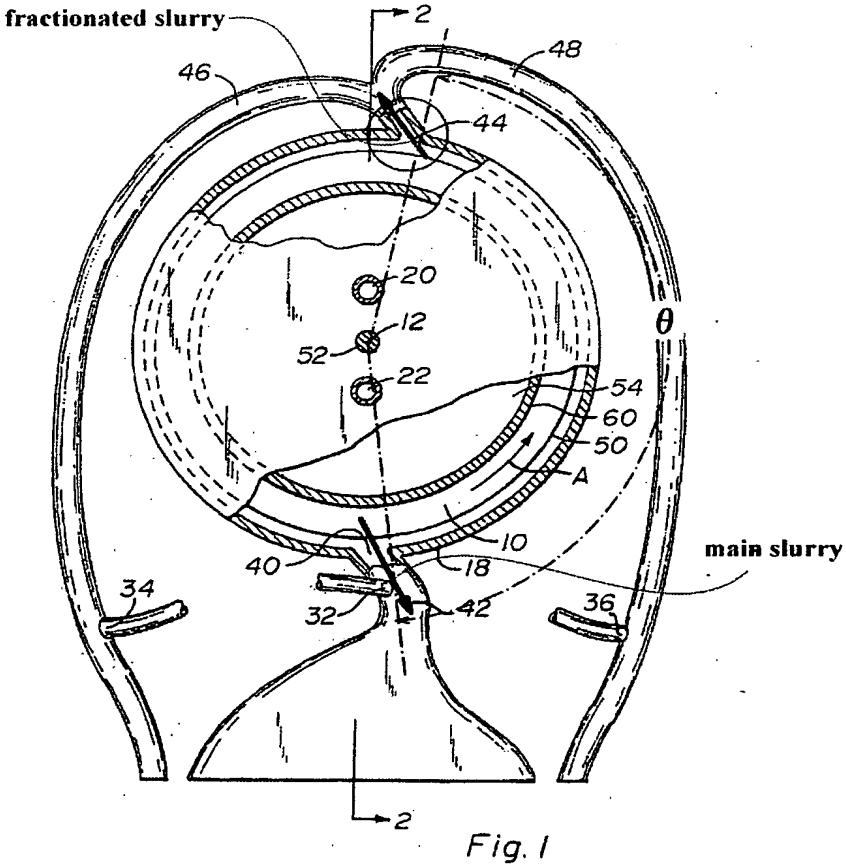
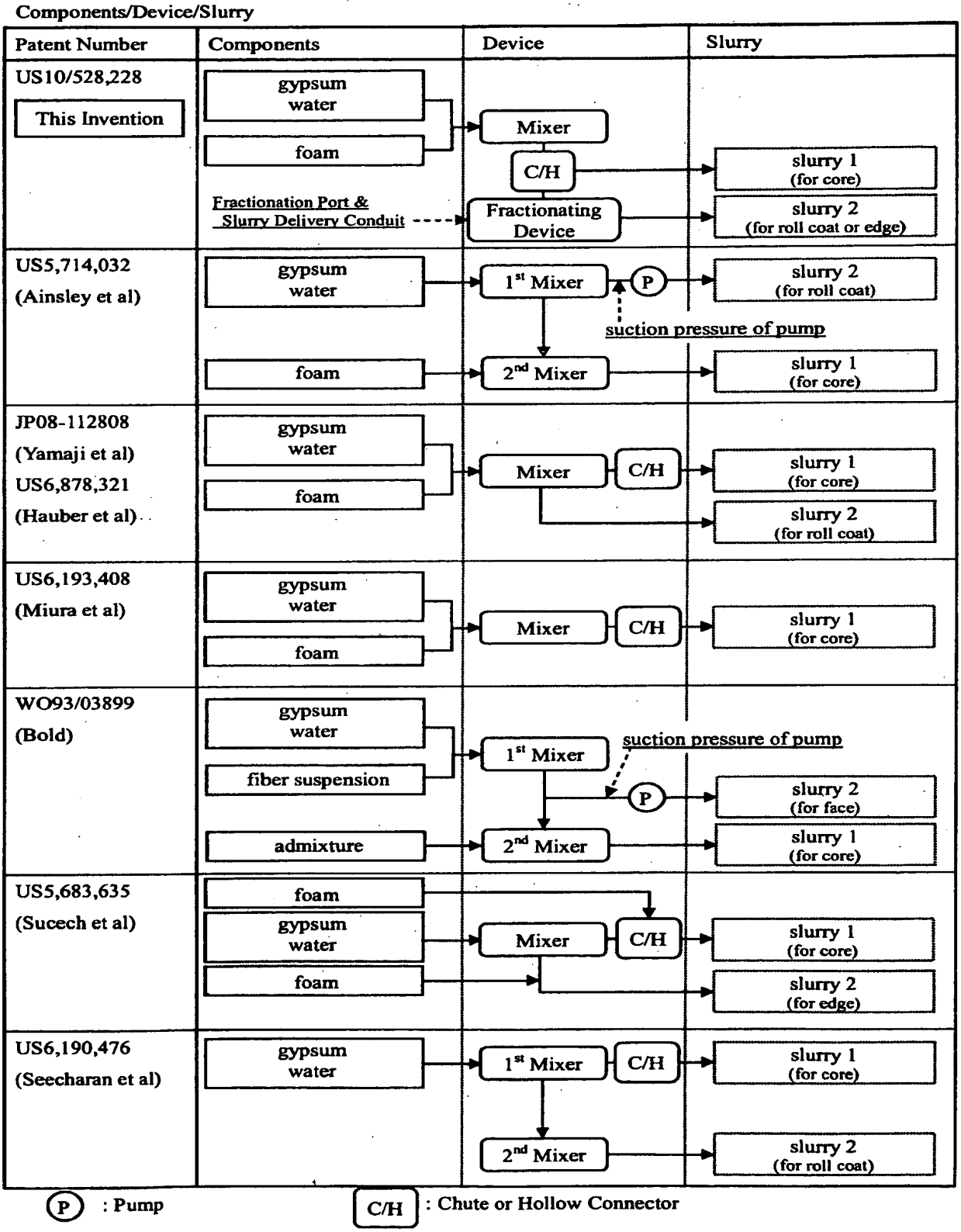


Fig. 1

Comparison of Process

Components/Device/Slurry



	Comparison of slurry 1 and 2		Comparison of Mixer	
	Slurry Conditions	Specific Gravity	Mixer	Mixer Output
US10/528,228 This Invention	Same	slurry 1 < slurry 2	1st	slurry 1 (for core) slurry 2 (for roll coat or edge)
US5,714,032	Not Same	slurry 1 < slurry 2	1st	slurry 2 (for roll coat)
			2nd	slurry 1 (for core)
JP08-112808 US6,878,321	Not Same	slurry 1 < slurry 2	1st	slurry 1 (for core) slurry 2 (for roll coat)
US6,193,408	(unexplained)		1st	slurry 1 (for core)
WO93/03899	Not Same	(unexplained)	1st	slurry 2 (for face)
			2nd	slurry 1 (for core)
US5,683,635	Not Same	slurry 1 < slurry 2	1st	slurry 1 (for core) slurry 2 (for edge)
US6,190,476	Not Same	slurry 1 < slurry 2	1st	slurry 1 (for core)
			2nd	slurry 2 (for roll coat)

5. After all, only in the apparatus of US patent application No. 10/528,228 (the present invention), the mixing condition of the fractionated slurry separated from the main mixer is the same as that of the main slurry, as shown in the above table.

According to the research and study of the inventors of the present invention, it is possible to partially extract the slurry from the chute or a hollow connector section with use of the internal pressure of the chute or the hollow connector section.

In a case where the slurry is fractionated from the chute or the hollow connector section, the following effects or advantages can be obtained:

(1) As shown in "Density of Slurry" of the table on the next page (a copy of FIG. 10 of US patent application No. 10/528,228), the standard deviations in the edge parts and the center part can be reduced, and therefore, the density of the slurry fractionated from the mixer can be substantially stabilized.

(2) As shown in "Rate of Change in Volume" of the table on the next page, change of the slurry flow rate can be reduced, and therefore, the flow rate of gypsum slurry can be stabilized.

(3) As shown in the table as below, the produced gypsum board exhibits excellent performances with respect to the adhesiveness of the right face, the standard deviation of the surface hardness, the average value of the core hardness, and the standard deviation of the core hardness.

(4) As shown in "Reduction of Consumption Rate" of the table as below, the consumption rate of the foaming agent and that of adhesive auxiliary agent can be significantly reduced.

THIS INVENTION

PRIOR ART
(1) US 5, 683, 635
(2) JP 08-112808

	Example-1		Example-2		Comparative Example	
Density of Slurry (g/cm^3)	Side Edge Part	Center Part	Side Edge Part	Center Part	Side Edge Part	Center Part
Average	1.23	1.08	1.24	1.06	1.24	1.05
Standard Deviation	0.036	0.038	0.034	0.037	0.072	0.041
Rate of Change in Volume of Fractionated Slurry (B/A)	0.99		1.02		0.82	
Adhesiveness (%)						
Right Side Face	99		99		90 (including test piece having side edge part exfoliated)	
Reverse Side Face	99		100		98	
Surface Hardness (kgf)						
Average	39.1		37.6		34.9	
Standard Deviation	2.73		2.54		4.13	
Core Hardness (kgf)						
Average	13.4		12.7		10.9	
Standard Deviation	1.58		1.48		1.93	
Reduction of Consumption Rate of Foaming Agent	0.7		0.8		1	
Reduction of Comsumption Rate of Adhesive Auxiliary Agent	0.6		0.6		1	

6. It is apparent that the fractionation of the slurry is not disclosed in US6,193,408(Miura et al) .

The possibility of fractionation of the slurry from the chute section or the hollow connector section is not disclosed in JP 08-112808 (Yamaji et al), US 5,683,635 (Sucech et al) and US 6,878,321 (Hauber et al) relating to conventional technique of fractionation in which the slurry is fractionated directly from the mixing area in the mixer.

Preparation of different slurry by different mixers as disclosed in US 5,714,032 (Ainsley et al), WO 93/03899 (Bold) and US 6,190,476 (Seecharan et al) is essentially different from the fractionation of the same slurry from the same mixer, and it leads to the difficulties (i),(ii),(iii) and (iv) as described on pages 3-4.

Use of a pump or pumps for fractionation of the slurry as the mixers as disclosed in US 5,714,032 (Ainsley et al) and WO 93/03899 (Bold) also leads to the difficulties (i),(ii),(iii) and (iv) as discussed on pages 3-4.

Unpredictable and unexpected results of the experiments can be obtained from the present invention as shown in the table on page 11, resulting from fractionation of the slurry at the chute or the hollow connector section.

Therefore, the present invention (U.S. Patent Application No. 10/528,228) could not have been inferred from United States Patent No. 5,714,032 (Ainsley et al), Japanese Patent Laid-open Publication No. 08-112808 (Yamaji et al), United States Patent No. 6,878,321 (Hauber et al), United States Patent No. 6,193,408(Miura et al), PCT International Publication No. WO 93/03899 (Bold), United States Patent No. 5,683,635 (Sucech et al), and United States Patent No. 6,190,476 (Seecharan et al).

I further declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful and false statements and the like so made are punishable by fine or imprisonment, or both, under Selection 1001 of Title 18 of the United State Code, and that such willful, false statements may jeopardize the validity of the application or any patent issuing thereon.

FURTHER, DECLARANT SAYETH NOT.

Date: December 1, 2008

Name: K. Niimi
Katsumi NIIMI

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Yukio YAMAJI et al.	:	Confirmation No.: 6232
Application No. 10/528,228	:	TC/Art Unit: 1733
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For: APPARATUS AND METHOD FOR FRACTIONATING GYPSUM SLURRY AND METHOD OF PRODUCING GYPSUM BOARD	:	Atty Docket: P70312US0

ASTM-C11-08b (pages 6-8)

Designation: C 11 – 08b

Standard Terminology Relating to Gypsum and Related Building Materials and Systems[1]

This standard is issued under the fixed designation C 11; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This standard covers terminology relating to gypsum and related building materials and systems. The terms are generically defined. More specific and expanded definitions may appear in appropriate standards.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

C 22/C 22M Specification for Gypsum
C 28/C 28M Specification for Gypsum Plasters
C 35 Specification for Inorganic Aggregates for Use in Gypsum Plaster
C 36/C 36M Specification for Gypsum Wallboard[3]
C 37/C 37M Specification for Gypsum Lath[3]
C 52 Specification for Gypsum Partition Tile or Block[3]
C 59/C 59M Specification for Gypsum Casting Plaster and Gypsum Molding Plaster
C 61/C 61M Specification for Gypsum Keene's Cement
C 317/C 317M Specification for Gypsum Concrete
C 318/C 318M Specification for Gypsum Formboard
C 472 Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete
C 473 Test Methods for Physical Testing of Gypsum Panel Products
C 475/C 475M Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
C 843 Specification for Application of Gypsum Veneer Plaster
C 557 Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing
C 587 Specification for Gypsum Veneer Plaster
C 588/C 588M Specification for Gypsum Base for Veneer Plasters[3]
C 1396/C 1396M Specification for Gypsum Board
E 84 Test Method for Surface Burning Characteristics of Building Materials
E 96/E 96M Test Methods for Water Vapor Transmission of Materials
E 119 Test Methods for Fire Tests of Building Construction and Materials
E 337 Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures)

3. Terminology

accelerator, *n*—a material that reduces setting time.

accessories, *n*—products fabricated for the purpose of forming corners, edges, control joints, or decorative effects.

adhesive, *n*—a substance capable of holding materials together by surface attachment.

admixture, *n*—a material other than water, aggregates, hydraulic cementitious material, and fiber reinforcement that is used as an ingredient to modify properties and is added to the batch before or during its mixture.

aggregate, *n*—an inert granular material which may be added to gypsum plasters. (C 35)

all purpose compound, *n*—a compound formulated and manufactured to serve as a taping or finishing compound, or both.

anhydrite, *n*—the mineral consisting primarily of anhydrous calcium sulfate, $CaSO_4$.

arris (of an arch), *n*—the outside corner or angle formed by the meeting of a wall surface with the curved surface of an arch (see Fig. 1).

base coat, *n*—any or all layers of plaster in place prior to application of finish coats.

DISCUSSION—The first application is normally called a scratch coat and the second application is referred to as a brown coat.

bedding coat, *n*—that coat of plaster to receive aggregate or other decorative material of any size, impinged or embedded into its surface, before it sets.

[1] This terminology is under the jurisdiction of ASTM Committee C11 on Gypsum and Related Building Materials and Systems and is the direct responsibility of Subcommittee C11.91 on Terminology and Editorial.

Current edition approved May 1, 2008. Published June 2008. Originally approved in 1916. Last previous edition approved in 2008 as C 11 – 08a.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Withdrawn.

*A Summary of Changes section appears at the end of this standard.

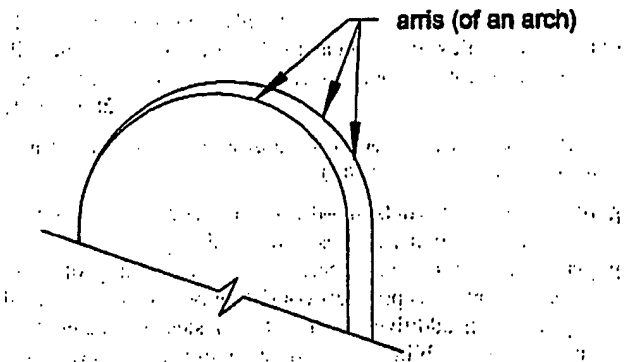

FIG. 1 Arris (of an Arch)

bond plaster, *n*—a calcined gypsum plaster specially formulated for application over rough monolithic concrete as a bonding coat for a subsequent gypsum plaster layer. (C 28/C 28M)

bridging, *n*—*in framing*, sections of wood or metal pieces used between framing members to stiffen, give lateral support, and minimize rotation.

brown coat, *n*—the second layer in three-coat plaster application.

building construction joint, *n*—a designed division of a building that allows movement of all component parts of the building, in any plane, which may be caused by thermal, seismic, wind loading, or any other force. The construction of the separation is accomplished by one of the following methods: (*1*) manufactured devices suitable for this application, or (*2*) by field fabrication of suitable materials.

calcined gypsum, *n*—a dry powder, primarily calcium sulfate hemihydrate, resulting from calcination of gypsum; cementitious base for production of most gypsum plasters; also called plaster of paris, sometimes called stucco.

calcium sulfate, *n*—the chemical compound $CaSO_4$.

cementitious material, *n*—a material that, when mixed with water, with or without aggregate, provides the plasticity and the cohesive and adhesive properties necessary for placement, and the formation of a rigid mass.

check cracking (in joint systems), *n*—short, narrow cracks randomly oriented in the surface of the dried joint compound.

coat, *n*—a layer of plaster applied in a single operation.

combined water, *n*—the water chemically held, as water of crystallization, by the calcium sulfate dihydrate or hemihydrate crystal.

compressive strength, *n*—the maximum load sustained by a standard specimen of a material when subjected to a crushing force.

consistency, *n*—a property of a material determined by the complete flow force relation. (C 557)

consistency (normal), *n*—the number of millilitres of water per 100 g of gypsum plaster or gypsum concrete required to produce a mortar or a slurry of specified fluidity. (C 472)

control (expansion-contraction) joint, *n*—a designed separation in the system materials that allows for movement caused by expansion or contraction of the system. The construction of the separation is accomplished by one of the following methods: (*1*) manufactured devices suitable for this application, or (*2*) by field fabrication of suitable materials.

core (of gypsum board), *n*—the hardened material filling the space between the face and back papers consisting substantially of rehydrated gypsum with additives.

cored tile or block, n—see **gypsum tile or block.** (C 52)

cornerbead, *n*—an accessory for outside corners.

corner reinforcement, exterior, *n*—a preformed section of wire or expanded sheet steel, for the reinforcement of exterior stucco external corners (arrises).

cure (portland cement plaster or stucco), *v*—(*1*) to provide conditions conducive to the hydration process of portland cement plaster or stucco, or (*2*) to maintain proper temperature and a sufficient quantity of water within the plaster to ensure cement hydration.

density, *n*—the weight per unit volume of a material. (C 472)

dried sample, *n*—a sample devoid of free water.

edge (of glass mat gypsum panels), *n*—the bound edge as manufactured.

edge (of gypsum board), *n*—the paper-bound edge as manufactured.

edge trim, *n*—an accessory to cover exposed ends or edges of gypsum board.

embedding compound—see **taping compound.**

end (of glass mat gypsum panels), *n*—the end perpendicular to the bound edge. The gypsum core is always exposed.

end (of gypsum board), *n*—the end perpendicular to the paper-bound edge. The gypsum core is always exposed.

expansion joint, n—see **control (expansion-contraction) joint.**

face, *n*—the surface designed to be left exposed to view or to receive decoration or additional finishes.

featured edge, *n*—an edge configuration of the paper bound edge of gypsum board that provides special design or performance.

fineness modulus, *n*—an empirical factor obtained by adding total percentages of a sample of aggregate retained on each of a specified series of sieves and dividing by 100. The sieve sizes used are: No. 100 (150 μm), No. 50 (300 μm), No. 30 (600 μm), No. 16 (1.18 mm), No. 8 (2.36 mm), No. 4 (4.75 mm), ⅜ in. (9.5 mm), ¾ in. (19.0 mm), 1½ in. (38.1 mm) and larger, increasing in the ratio of 2 to 1.

finish coat, *n*—the final layer of plaster applied over a basecoat or other substrate.

finishing compound, *n*—(*sometimes called topping compound*) a compound specifically formulated and manufactured for use over taping or all purpose compounds to provide a smooth and level surface for the application of decoration.

fire-resistance classification, *n*—a standard rating of fire-resistance and protective characteristics of a building construction or assembly. (E 119)

flame spread classification, *n*—a standard rating of relative surface burning characteristics of a building material as

compared to a standard material. (E 84)

flexural strength, *n*—the maximum load sustained by a standard specimen of a sheet material when subjected to a bending force.

floating, *v*—the act of spreading, compacting, or consolidating to achieve a specified uniform appearance.

framing member, *n*—stud, plate, track, joist, furring, and other support to which a gypsum panel product, or metal plaster base is attached.

free water, *n*—all water contained by gypsum board or plaster in excess of that chemically held as water of crystallization.

gauging plaster, *n*—a calcined gypsum plaster designed to be mixed with lime putty. (C 28/C 28M)

glass mat, *n*—a woven or non-woven fabric of glass fibers with or without a binder.

grout, *n*—gypsum or portland cement plaster used to fill crevices or to fill hollow metal frames.

gypsum, *n*—the mineral consisting primarily of fully hydrated calcium sulfate, $CaSO_4 \cdot 2H_2O$ or calcium sulfate dihydrate. (C 22/C 22M)

gypsum backing board, *n*—a ¼ in. to ⅝ in. gypsum board for use as a backing for gypsum wallboard, acoustical tile, or other dry cladding.

water resistant gypsum backing board—a gypsum board designed for use on walls primarily as a base for the application of ceramic, or plastic tile.

gypsum base for veneer plasters, *n*—a gypsum board used as the base for application of a gypsum veneer plaster. (C 588/C 588M)

gypsum board, *n*—the generic name for a family of sheet products consisting of a noncombustible core primarily of gypsum with paper surfacing.

gypsum casting plaster, *n*—a calcined gypsum plaster used primarily to form objects, such as lamp bases, art ware, and novelties, etc. (C 59/C 59M)

gypsum concrete, *n*—a calcined gypsum mixed with wood chips or aggregate, or both. (C 317/C 317M)

gypsum core board, *n*—a ¾ in. (19.0 mm) to 1 in. (25.4 mm) gypsum board consisting of a single board or factory laminated multiple boards, used as a gypsum stud or core in semisolid or solid gypsum board partitions.

gypsum formboard, *n*—a gypsum panel product used as the permanent form for poured gypsum roof decks. (C 318/C 318M)

gypsum lath, *n*—a gypsum board used as the base for application of gypsum plaster. (C 37/C 37M)

perforated gypsum lath—a gypsum lath having perforations to provide mechanical keying of the basecoat plaster.

foil-backed gypsum lath—the same as plain gypsum lath except that in addition, the back surface shall be covered with a continuous sheet of pure bright finished aluminum foil.

type X lath—a gypsum lath specially manufactured to provide specific fire-resistant characteristics.

gypsum molding plaster, *n*—a calcined gypsum plaster used primarily for plaster casts or molds, sometimes used as a gauging plaster. (C 59/C 59M, C 28/C 28M)

gypsum neat plaster, *n*—a calcined gypsum mixed at the mill with ingredients to control working quality and setting time. (C 28/C 28M)

DISCUSSION—Neat plaster is either fibered or unfibered. The addition of aggregate is required on the job.

gypsum panel products, *n*—the general name for a family of sheet products consisting essentially of gypsum.

gypsum plaster, *n*—the generic name for a family of powdered cementitious products consisting primarily of calcined gypsum with additives to modify physical characteristics, and having the ability, when mixed with water, to produce a plastic mortar or slurry which can be formed to the desired shape by various methods and will subsequently set to a hard, rigid mass. (C 28/C 28M)

gypsum sheathing, *n*—a gypsum board used as a backing for exterior surface materials, manufactured with water-repellant paper and may be manufactured with a water-resistant core. (C 1396/C 1396M)

gypsum tile or block, *n*—a cast gypsum building unit. (C 52)

gypsum veneer plaster systems, *n*—veneer plaster applied in accordance with Specification C 843 to gypsum base for veneer plasters.

gypsum wallboard, *n*—a gypsum board used primarily as an interior surfacing for building structures. (C 36/C 36M)

foil-backed gypsum wallboard—a gypsum wallboard with the back surface covered with a continuous sheet of pure bright finished aluminum foil. (C 36/C 36M)

type X gypsum wallboard—a gypsum wallboard specially manufactured to provide specific fire-resistant characteristics (C 36/C 36M).

gypsum wood-fibered plaster, *n*—a calcined gypsum plaster containing shredded or ground wood fiber added during manufacture.

hemihydrate, *n*—the dry powder, calcium sulfate hemihydrate, resulting from calcination of $CaSO_4 \cdot 2H_2O$, calcium sulfate dihydrate. See **calcined gypsum.**

joining, *n*—the juncture of two separate plaster applications of the same coat, usually within a single surface plane.

joint compound, *n*—a compound used for taping or finishing gypsum board, or both.

joint tape, *n*—a type of paper, metal, fabric, glass mesh, or other material, commonly used with a cementitious compound, to reinforce the joints between adjacent gypsum boards. (C 475/C 475M)

joint tape, self-adhering, *n*—a joint tape manufactured to adhere directly to the substrate.

DISCUSSION—Tapes having this quality do not require mechanical or embedment means of attachment to the substrate.

Keene's cement, *n*—an anhydrous gypsum plaster characterized by a low mixing water requirement and special setting properties, primarily used with lime to produce hard, dense finish coats. (C 61/C 61M)

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	:	
Yukio YAMAJI et al.	:	Confirmation No.: 6232
Application No. 10/528,228	:	TC/Art Unit: 1733
Filed: March 18, 2005	:	Examiner: Steven Maki
For: APPARATUS AND METHOD FOR FRACTIONATING GYPSUM SLURRY AND METHOD OF PRODUCING GYPSUM BOARD	:	Atty Docket: P70312US0

ASTM-C1396/C1396M-06a (pages 608-609)

Designation: C 1396/C 1396M – 06a

Standard Specification for Gypsum Board[1]

This standard is issued under the fixed designation C 1396/C 1396M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This specification covers the gypsum boards described in 1.1.1-1.1.9.

NOTE 1—Specifications C 840, C 841, C 844 and C 1280 contain application procedures for gypsum board.

1.1.1 *Gypsum wallboard*, designed for use on walls, ceilings, or partitions and that affords a surface suitable to receive decoration.

1.1.2 *Predecorated gypsum board*, designed for use as the finished surfacing for walls, ceilings, or partitions.

1.1.3 *Gypsum backing board, coreboard, and shaftliner board*, designed for use as a base in multilayer systems or as a gypsum stud or core in semisolid or solid gypsum board partitions, or in shaft wall assemblies.

NOTE 2—The terms backing board, coreboard, and shaftliner board refer to different end uses. The term gypsum backing board, as used in this specification, shall include gypsum coreboard and gypsum shaftliner board unless otherwise stated.

1.1.4 *Water-resistant gypsum backing board*, designed primarily to be used as a base for the application of ceramic or plastic tile on walls or ceilings. This product is also suitable for decoration.

1.1.5 *Exterior gypsum soffit board*, designed for use on exterior soffits and carport ceilings that are completely protected from contact with liquid water.

1.1.6 *Gypsum sheathing board*, designed for use as sheathing on buildings.

1.1.7 *Gypsum base for veneer plaster*, designed for use as a base for the application of gypsum veneer plaster.

1.1.8 *Gypsum lath*, designed for use as a base for the application of gypsum plaster.

1.1.9 *Gypsum ceiling board*, designed for use on interior ceilings with framing spaced not more than 24 in. [610 mm] on center and that affords a surface suitable to receive water-based texture and other decoration. This product is also suitable for use on interior walls.

1.2 Specifications applicable to all gypsum boards are located in Section 1-4 and 13-15. Specifications applicable to specific gypsum boards are located in the following sections:

	Section
Gypsum wallboard, predecorated gypsum board	5
Gypsum backing board, gypsum coreboard, gypsum shaftliner board	6
Wafer-resistant gypsum backing board	7
Exterior gypsum soffit board	8
Gypsum sheathing board	9
Gypsum base for veneer plaster	10
Gypsum lath	11
Gypsum Ceiling Board	12

1.3 The values stated in either inch-pound units or SI (metric) are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system shall be used independent of the other. Values from the two systems shall not be combined.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

C 11 Terminology Relating to Gypsum and Related Building Materials and Systems

C 473 Test Methods for Physical Testing of Gypsum Panel Products

C 645 Specification for Nonstructural Steel Framing Members

C 840 Specification for Application and Finishing of Gypsum Board

C 841 Specification for Installation of Interior Lathing and Furring

C 844 Specification for Application of Gypsum Base to Receive Gypsum Veneer Plaster

C 1264 Specification for Sampling, Inspection, Rejection, Certification, Packaging, Marking, Shipping, Handling, and Storage of Gypsum Panel Products

C 1280 Specification for Application of Gypsum Sheathing

E 84 Test Method for Surface Burning Characteristics of Building Materials

[1] This specification is under the jurisdiction of ASTM Committee C11 on Gypsum and Related Building Materials and Systems and is the direct responsibility of Subcommittee C11.01 on Specifications and Test Methods for Gypsum Products.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard.

E 96/E 96M Test Methods for Water Vapor Transmission of Materials

E 119 Test Methods for Fire Tests of Building Construction and Materials

3. Terminology

3.1 Definitions used in this specification shall be in accordance with Terminology C 11.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *decorative coating, n*—a paint or other liquid material with or without aggregate.

3.2.2 *decorative sheet or film, n*—a plastic film, either backed or unbacked; plastic sheet; or combination of these.

3.2.3 *edge, n*—the bound edge as manufactured.

3.2.4 *gypsum backing board, n*—a ¼ to ⅝-in. [6.4 to 15.9-mm] gypsum board used as a backing for gypsum wallboard, acoustical tile, or other dry cladding.

3.2.5 *gypsum coreboard, n*—a ¾ to 1-in. [19.0 to 25.4-mm] gypsum board used as a gypsum stud or core in semisolid or solid gypsum board partitions.

3.2.6 *nominal thickness, n*—the manufacturer-stated fractional value of thickness of the gypsum panel product expressed in decimal value to the nearest one-thousandth (1/1000) of an inch.

4. Materials and Manufacture

4.1 Gypsum board shall consist of a noncombustible core, essentially gypsum, surfaced with paper bonded to the core.

4.1.1 Gypsum sheathing board shall consist of a noncombustible water-resistant core, essentially gypsum, surfaced on both the face and back with water-repellant paper bonded to the core.

4.1.2 Gypsum coreboard shall be either a single board or composed of two factory-laminated gypsum boards to provide up to 1 in. [25.4 mm] total nominal thickness.

4.1.3 Water-resistant gypsum backing board shall consist of a noncombustible water-resistant core, essentially gypsum, surfaced on both the back and face with water-repellant paper bonded to the core.

4.1.4 Predecorated gypsum board shall consist of a noncombustible core, essentially gypsum, surfaced with paper bonded to the core with the face covered with a decorative sheet, film, or coating.

4.1.4.1 Class I predecorated gypsum board shall have a decorative sheet or film laminated to the face.

4.1.4.2 Class II predecorated gypsum board shall have a decorative coating applied to the face.

4.2 The back surface of foil-backed gypsum board shall in addition be covered with aluminum foil.

4.3 *Gypsum Board, type X* (Special Fire-Resistant):

4.3.1 *Gypsum Board*, type X, designates gypsum board, except gypsum lath, gypsum coreboard, and gypsum shaftliner board, complying with this specification that provides not less than 1 h fire-resistance rating for boards ⅝ in. [15.9 mm] thick or ¾ h fire-resistance rating for boards ½ in. [12.7 mm] thick, applied parallel with and on each side of load bearing 2 by 4 wood studs spaced 16 in. [406 mm] on centers with 6d coated nails, 1⅞ in. [48 mm] long, 0.0915-in. [2.3-mm] diameter shank, ¼-in. [6.4-mm] diameter heads, spaced 7 in. [178 mm] on centers with gypsum board joints staggered 16 in. [406 mm] on each side of the partition and tested in accordance with Test Methods E 119.

4.3.2 *Gypsum Lath*, type X designates gypsum lath complying with this specification that provides not less than a 1-h fire-resistance rating for gypsum lath ⅜ in. [9.5 mm] thick, when applied at right angles to and on each side of loadbearing 2 × 4 wood studs spaced 16 in. [406 mm] on centers with blue lath nails spaced 5 in. [127 mm] on centers over which is applied ½ in. [12.7 mm] 1:2 gypsum sand plaster and tested in accordance with the requirements of Test Method E 119.

NOTE 3—Consult producers for independent test data on assembly details and fire-resistance ratings for other types of construction. See fire test reports or listings from recognized fire testing laboratories for assembly particulars, materials, and ratings.

4.3.3 Gypsum shaftliner board, type X, designates gypsum shaftliner board complying with this specification that meets the acceptance criteria for temperature rise for not less than 1-½ h for boards ¾-in. [19.0 mm] thick or 2 h for boards 1-in. [25.4 mm] thick, when applied in a double layer solid nonload bearing partition as described in 4.3.3.1 and tested in accordance with Test Methods E 119 with thermocouple locations as specified in 4.3.3.2.

4.3.3.1 Two layers of gypsum shaftliner board applied vertically and friction fit into vertical 25-gage steel "H" members, 1-½-in. [38.1 mm] deep for boards ¾-in. [19.0 mm] thick or 2-in. [50.8 mm] deep for boards 1-in. [25.4 mm] thick, spaced 24-in. [610 mm] on centers and 25-gage steel track at the perimeter of the partition. "H" members shall be formed with a single web or shall be two pieces of perimeter track fastened together along the web with screws spaced 24-in. [610 mm] on centers.

4.3.3.2 Temperature rise on the unexposed surface shall be measured using not less than five thermocouples; one shall be located at the center of the assembly and one shall be located at the center of each quadrant. Thermocouples shall be located not less than 3-in. [76 mm] from an "H" member.

4.4 Gypsum wallboard, gypsum backing board, exterior gypsum soffit board, and gypsum ceiling board shall have a flame spread index of not more than 25 when tested in accordance with Test Method E 84.

4.5 *Physical Properties, Dimensions, and Tolerances of Gypsum Board*:

4.5.1 Specimens shall be taken from the samples obtained in accordance with Specification C 1264.

4.5.1.1 Specimens shall be tested in accordance with Test Methods C 473.

4.5.2 *Core, End, and Edge Hardness*—The specimens shall have an average hardness of not less than 15 lbf [67 N] when tested by Method A and 11 lbf [49 N] when tested by Method B.

4.5.3 *Edges and Ends*—The edges and ends shall be straight.

4.5.4 *Length*—The tolerance in length shall be ±¼ in. [±6 mm].

4.5.5 *Tapered Edge Depth*—The average thickness of the edge of recessed or tapered edge gypsum board shall be not